Using Path Analysis with Educational Program RCT data

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RCTs can play a role in building scientific knowledge and useful predictions but they can only do so as part of a cumulative program, combining with other methods, including conceptual and theoretical development, to discover not “what works,” but “why things work”.

Understanding and misunderstanding randomized controlled trials
Angus Deaton and Nancy Cartwright (2016)

Aim of this paper

- To change the perception that RCT data can only be used to find IF a program works.
- That RCT data can be analysed in different ways to also explore WHY programs work (or do not work).

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Perceptions of RCT Data Analysis

CAUSE  EFFECT

Really good at finding out **IF** an educational program works…

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Perceptions of RCT Data Analysis

CAUSE

EFFECT

…but considered not good at finding out **WHY** the program works.

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Accepted ways to look inside the black box?

- Logic model (theoretical picture of the black box but untested)
- Process evaluation (focuses on black box but generally qualitative and subjective)
- Implementation analysis (explores some elements of the black box but generally focused on activities rather than outcomes).
- …but in an RCT we usually have a range of data on outcomes and implementation. This provides quantitative, context specific data.

- Can we analyse this data in a different ways to investigate the black box?
  - One potential method is Path Analysis
  - Example analysis – *Mate-tricks* program RCT

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The *Mate-Tricks* Programme

- A one year pro-social behaviour after-school programme
- Area of significant disadvantage in Dublin, Ireland
- 59 child only, 6 parent only (13%) and 3 family sessions (4%)
- RCT of 592 children (traditional analysis)
  - Outcome evaluation
  - Process Evaluation (Qualitative)
  - Implementation Evaluation (Quantitative)
  - All done separately

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Measures

- Range of Outcome measures (including):
  - Pro-social behaviour
  - Anti-social behaviour
  - Liberal parenting
  - Supportive parenting
  - Authoritarian parenting
- Implementation Measures
  - Parental Attendance (Dosage)
  - Child Attendance (Dosage)
  - Child satisfaction with the program
  - Child relationship with the facilitator

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Original RCT Effects

Four significant adverse effects (from child self-report)

- Anti-social behavior (PSB Questionnaire) ES = .18
- Anti-social behavior (CBCL Questionnaire) ES = .20
- Authoritarian Parenting (APQ) ES = .20
- Liberal parenting (APQ) ES = .16

- No significant positive effects

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Process evaluation findings

- The views and observations of the *Mate-Tricks (MT)* program were very positive.
- This is in contrast with main programme effects. Why?
- Engaged parents and their children took part in the process evaluation therefore they were more favourable towards the programme
- These findings might suggest that *Mate-Tricks* worked successfully for engaged families
- A program for these families alone would not meet the original aims based on whole community disadvantage.

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Original Implementation Findings

- *MT* outcomes were influenced by a range of factors
  - Parent attendance, Children attendance, Child satisfaction
  - Overall low parent attendance was the most significant predictor of negative outcomes

- Program satisfaction also influenced outcomes
  - Satisfaction with programme predicted pro-social behaviour
  - Relationship with facilitator predicted anti-social behaviour

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Original theories on what went wrong?

- Program had theory of change issues (no logic model)
  - Large imbalance of child and parent sessions
  - Difficulties in engaging parents
  - Pattern of effects were parents ‘Giving up’ (liberal) or ‘Cracking down’ (authoritarian) and children ‘Acting out’ (anti-social)
  - Program potentially set up competitive goal structures **competitive emotional learning** rather than **cooperative emotional learning**
  - However, these are untested theories; so we decided to explore it in more depth with Path Analysis

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Path Analysis

- Subset of Structural Equation Modelling
- Path analysis only deals with observed variables
- Allows the specification of complex a prori models (e.g., direct, indirect, mediation, moderation, etc.) reporting magnitude & significance of paths between variables
- Compares the relationships in the model with the relationships that exist in the data; reports these as Goodness-of-Fit Indices
- Simple example from *MT*

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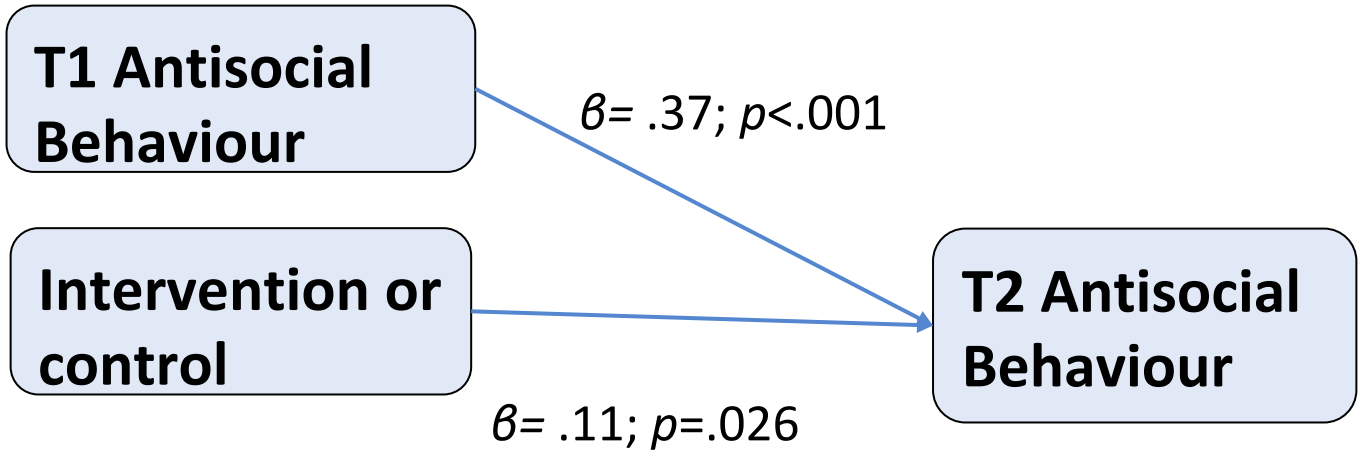
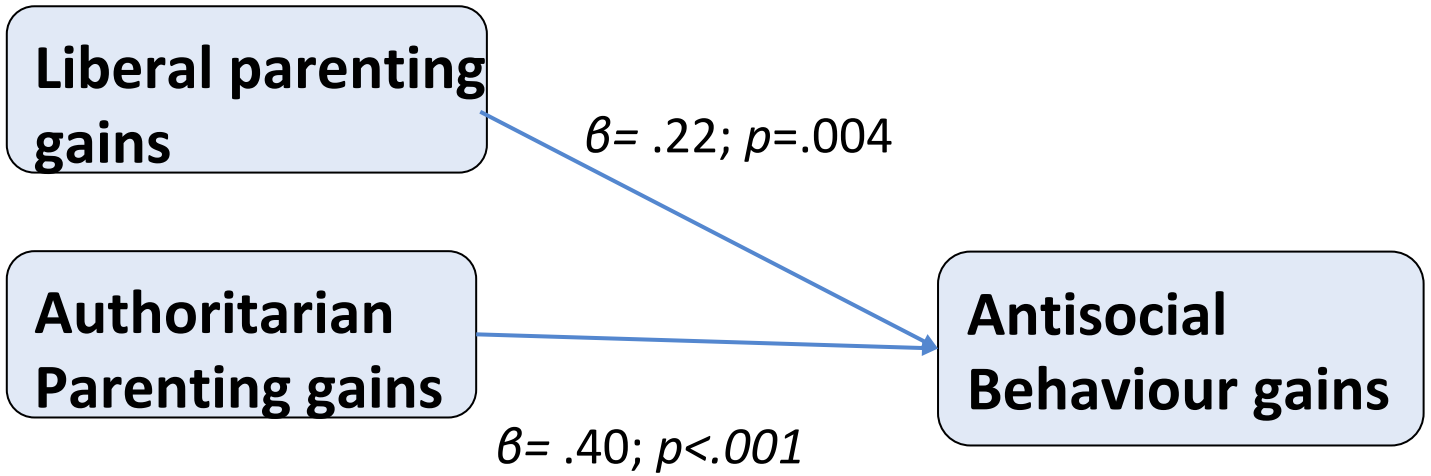
Replication of RCT results



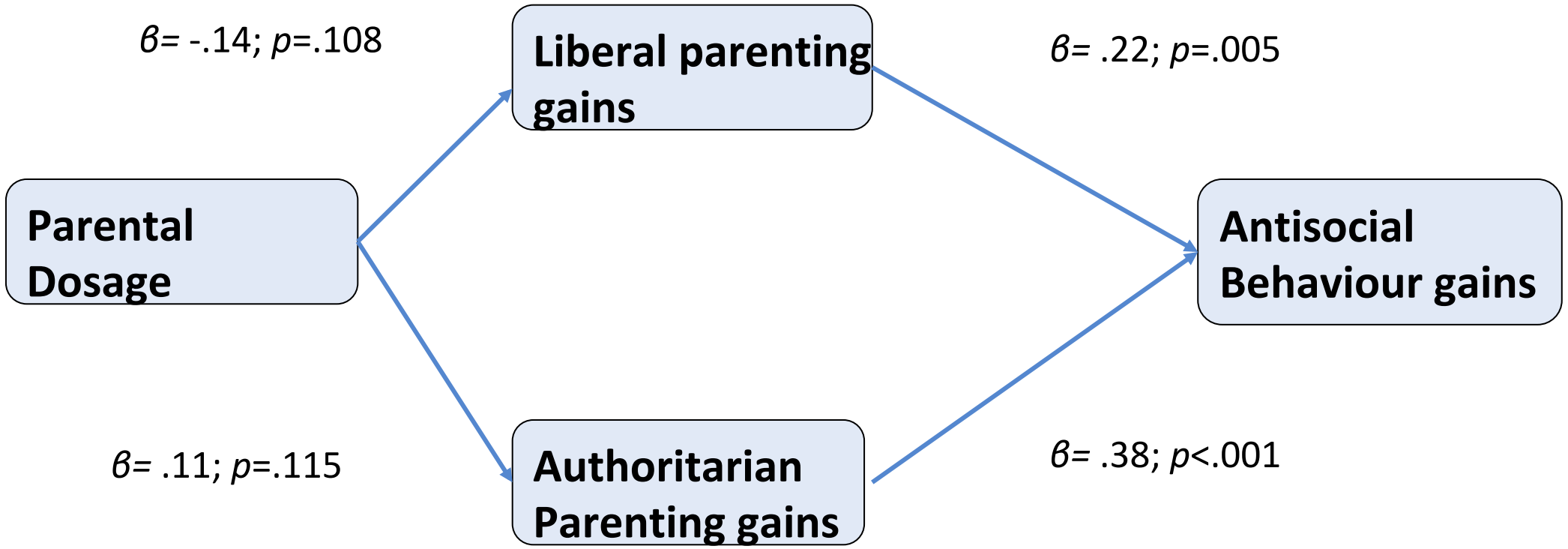
χ^2 (1, n=592) = 1.82, p=.177; RMSEA = .04; CFI = .98; TLI = .90

Model 1 (Outcomes only) Parenting and behaviour



χ^2 (1, n=304) = 14.40, p<.001; RMSEA = .21; CFI = .69; TLI = .83

Model 2 (Outcomes & Implementation) Parenting, Dosage & behaviour



χ^2 (1, n=304) = .69, p=.406; RMSEA ≈ .00; CFI ≈ .99; TLI = 1.06

How did we look inside the black box?

- Traditional process evaluation
  - Missed lost voices on negative effects
- Implementation analysis
  - Showed parental engagement was a problem
- Path Analysis
  - Drew together outcome data as well as implementation data
  - Tested a theory on WHY the programme did not work (looked inside the black box). Parental dis-engagement led to **competitive emotional learning**
  - There are more holistic ways to analyse the data provided through RCTs to allow researchers to answer IF and WHY questions about educational programs.

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More Information

O'Hare, L., Biggart, A., Kerr, K., & Connolly, P. (2015). A randomized controlled trial evaluation of an after-school prosocial behavior program in an area of socioeconomic disadvantage. The Elementary School Journal, 116(1), 1-29.

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